Transient Analysis Upgrade for Atomic Emission, ICP Simultaneous Spectrometers

"Trulogic and its partner, McGill University, have codeveloped a new technology that has the potential to significantly enhance analytical performance of spectrometers.

Ken Mehta
Vice President
Trulogic Systems Inc.
Mississauga, Ontario

THE COMPANY

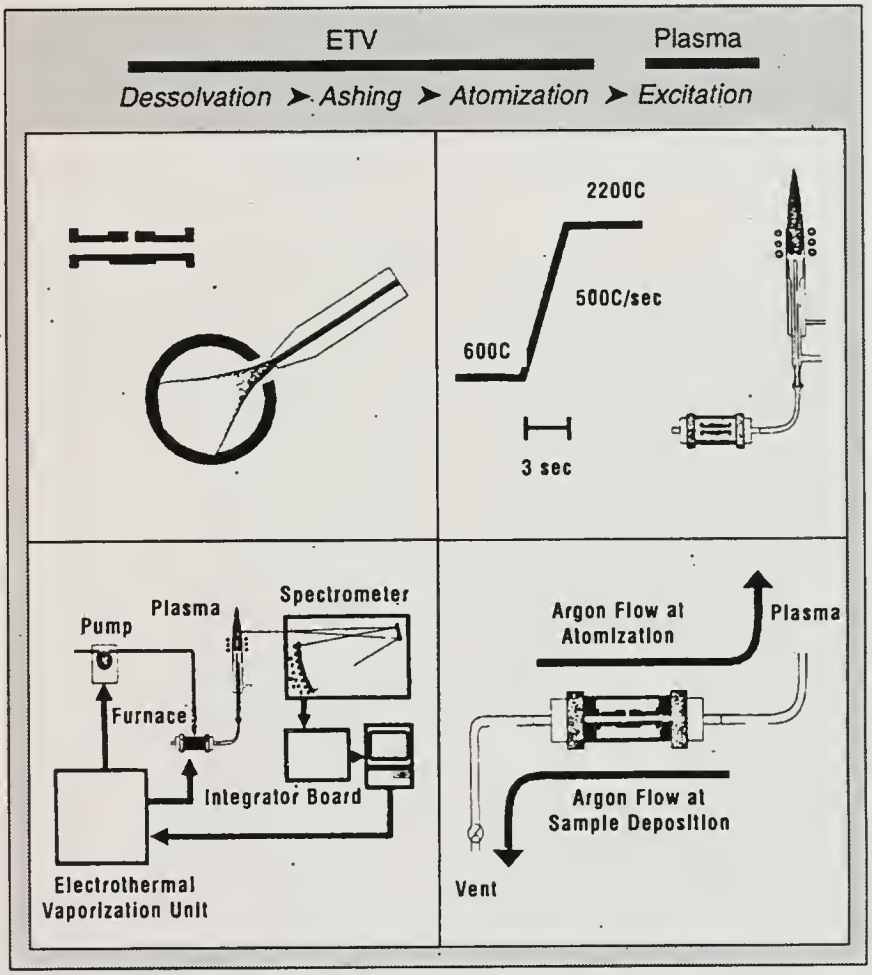
Trulogic Systems Inc., an innovator in the field of spectrometry applications and upgrading, grew out of work done at TSL Inc., a chemical laboratory providing analytical services in the environmental field. Since 1991, sales have grown by more than 70 per cent annually. Growth in the market and in demand for the technology is anticipated at 50 per cent annually during the next three to five years.

In addition to its technology development interests, Trulogic is the Canadian distributor for analytical instrumentation products of Questron Corporation, of the United States, and Jobin-Yvon Emission, of France.

THE CHALLENGE

Conventional methods for introducing samples to Inductively Coupled Plasma (ICP) Spectrometers employ a nebulizer — which transforms the sample to a mist-like condition — to carry the sample into the plasma in a stream of argon gas. Only about three per cent of the sample actually enters the plasma; the rest is wasted. With transient or scanning techniques, 100 per cent of the sample is seen by the plasma. As a result, detection limits are significantly improved or lowered — that is, even smaller amounts of pollutants can be detected.

One major application of this technology is as a low-cost, high-performance tool enabling small operators to perform analyses for toxic elements and trace metals, especially in drinking water supplies.



Rapid Sample Preconcentration by Spray Deposition for ETV-ICP-AES

TECHNOLOGY DESCRIPTION

The apparatus consists of a graphite Electrothermal Vaporization (ETV) Unit into which the sample is deposited by a nebulizer. The ETV unit is then heated to evaporate moisture and acids which are removed by a stream of argon gas. The ETV unit is then rapidly heated to 2200 degrees Celsius to atomize the sample, which is then transported to the plasma in a stream of argon gas. The sample is in the plasma, which has a temperature of 8000 degrees C, for only two to three seconds — sufficient time for the plasma to dissociate the molecules and excite the atoms. The excited atoms emit radiation at characteristic wavelengths for each element. The light enters the Spectrometer optics and is then diffracted by a grating. Exit slits and detectors placed at precise wavelengths capture the radiation emitted by the elements in the sample.

During the two to three-second time frame that a sample is in the plasma, all readings for a sample that may contain up to 30 elements have to be acquired and processed by the spectrometer electronics. This requires capability for extremely fast acquisition of electronic data. Trulogic has the most advanced data acquisition electronics in the industry. It can

acquire and process electronic signals from eight to 16 times faster than the competition. Thus, Spray Deposition ETV Sample Preconcentration technology can only work with Trulogic's data acquisition systems at the present time. Spectrometer systems manufactured and upgraded by Trulogic over the past five years all include this electronic hardware. This apparatus could be retrofitted to any PMT- based Simultaneous ICP Spectrometer manufactured by Trulogic or by any of the major manufacturers such as Jarrel-Ash, J-Y, ARL, Baird and others.

RESULTS

In the Spray Deposition ETV Sample Preconcentration Method, 100 per cent of the sample is seen by the plasma. As a result, detection limits are significantly improved. Preliminary tests have indicated that detection limits for water samples have been improved by factors of from 500 to 600. An ICP Spectrometer with this level of detection capability would achieve a level of performance equal to that of a mass spectrometer, at a fraction of the cost. (A mass spectrometer typically costs $300,000 — two to three times as much as an ICP Spectrometer.)

TECHNOLOGY OPPORTUNITIES

The primary market for this technology is in organizations concerned with the protection, treatment and testing of drinking water, groundwater and surface waters affecting human health. Municipalities with water treatment plants and other agencies or corporations providing drinking water to the general population require instrumentation to test water for the presence of toxic elements such as arsenic, lead or mercury at trace levels.

Trulogic is able to provide instrumentation at a fraction of the cost of competing systems. The market will expand as Trulogic develops additional capabilities for testing salt water, soil, geologic and food samples.

PARTNERSHIP IN POLLUTION PREVENTION AND RESOURCE CONSERVATION

The development and demonstration of this Trulogic technology has been partly supported by the Ontario Ministry of the Environment.

Trulogic has also worked closely with McGill University through the technical and commercialization phases. McGill is involved in the testing of prototypes and in the development of software.

Industrial companies located in Ontario may seek ministry/industry services which will help them to:

* reduce, reuse and recycle solid waste;
* clean up historic pollution effectively and destroy hazardous contaminants;
* reduce or eliminate liquid effluent and gaseous emissions;
* use energy and water more efficiently.

Equipment and service supply companies can benefit from the information provided on technologies identified for business development.

FOR FURTHER INFORMATION, PLEASE CONTACT:

Ken Mehta, Vice-President
Trulogic Systems Inc.
6741 Columbus Road, Unit 12
Mississauga, Ontario
L5T 2G9
Tel: (905) 564-8417
Fax: (905) 564-7356

Kirsten Mania
Industry Conservation Branch
Ministry of the Environment
2 St. Clair Ave. West, 14th Floor
Toronto, Ontario
M4V 1L5
Tel: (416) 327-8072
Fax: (416) 327-1261
INTERNET: maniak@gov.on.ca

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